

IN THE CLAIMS:

Please amend claims 4, 5, 12, 13, 15, and 19 as shown in the complete list of claims that is presented below.

1. (original) A high-speed low-noise charge pump comprising:
an output node;
a first cascode current mirror coupled to a first reference current source and
adapted to generate a first mirror current, including a first output mirror
transistor and a first output cascode transistor;
a second cascode current mirror coupled to a second reference current source and
adapted to generate a second mirror current, including a second output
mirror transistor and a second output cascode transistor coupled to the first
output cascode transistor at the output node;
a first switching transistor being turned on during assertion of a first control signal
to cause the first mirror current to flow through the output node, having a
gate, a source and a drain where the source of the first switching transistor
is coupled to the first output mirror transistor, the drain of the first
switching transistor is coupled to the first output cascode transistor, and
the gate of the first switching transistor receives the first control signal;
and
a second switching transistor being turned on during assertion of a second control
signal to cause the second mirror current to flow through the output node,
having a gate, a source and a drain where the source of the second
switching transistor is coupled to the second output mirror transistor, the
drain of the second switching transistor is coupled to the second output
cascode transistor, and the gate of the second switching transistor receives
the second control signal.

2. (original) The charge pump as recited in claim 1 wherein:
the first output mirror, the first output cascode and the first switching transistors
are n-channel MOS transistors; and
the second output mirror, the second output cascode, and the second switching
transistors are p-channel MOS transistors.

3. (original) The charge pump as recited in claim 2 wherein:
the first output mirror transistor has a drain coupled to the source of the first
switching transistor and a source coupled to ground;
the first output cascode transistor has a source coupled to the drain of the first
switching transistor and a drain coupled to the output node;
the second output mirror transistor has a drain coupled to the source of the second
switching transistor and a source coupled to a voltage supply; and
the second output cascode transistor has a source coupled to the drain of the
second switching transistor and a drain coupled to the first output cascode
transistor at the output node.

4. (currently amended) The charge pump as recited in claim 1 wherein the first
and the second cascode current mirrors are a wide-swing cascode current ~~mirror~~ mirrors
featuring high output impedance without greating restriction a signal swing.

5. (currently amended) The charge pump as recited in claim 4 wherein:
the first cascode current mirror further comprises:
a first input mirror transistor coupled ~~between~~ to the first output mirror
transistor and ground; and
a first input cascode transistor coupled ~~between~~ to the first output cascode
transistor and the first reference current source; and
the second cascode current mirror further comprises:
a second input mirror transistor coupled ~~between~~ to the second output
mirror transistor and a voltage supply; and
a second input cascode transistor coupled ~~between~~ to the second output
cascode transistor and the second reference current source.

6. (original) The charge pump as recited in claim 5 wherein:
the first input mirror and the first input cascode transistors are n-channel MOS transistors; and
the second input mirror and the second input cascode transistors are p-channel MOS transistors.
7. (original) The charge pump as recited in claim 6 wherein:
the first input mirror transistor has a gate coupled to the first output mirror transistor and a source coupled to the ground;
the first input cascode transistor has a gate coupled to the first output cascode transistor and a drain coupled to the gate of the first input mirror transistor and the first reference current source;
the second input mirror transistor has a gate coupled to the second output mirror transistor and a source coupled to the voltage supply; and
the second input cascode transistor has a gate coupled to the second output cascode transistor and a drain coupled to the gate of the second input mirror transistor and the second reference current source.
8. (original) A high-speed low-noise charge pump comprising:
an output node;
a reference current source providing a supply current;
a first cascode current mirror coupled to the reference current source and adapted to generate a first mirror current from the supply current, including a first output mirror transistor and a first output cascode transistor;
a second cascode current mirror coupled to the reference current source and adapted to generate a second mirror current from the supply current, including a second output mirror transistor and a second output cascode transistor coupled to the first output cascode transistor at the output node;
a first switching transistor interposed between the first output mirror and the first output cascode transistors, being turned on during assertion of a first control signal to cause the first mirror current to flow through the output node; and

a second switching transistor interposed between the second output mirror and the second output cascode transistors, being turned on during assertion of a second control signal to cause the second mirror current to flow through the output node.

9. (original) The charge pump as recited in claim 8 wherein:

the first switching transistor has a gate, a source and a drain, where the source of the first switching transistor is coupled to the first output mirror transistor, the drain of the first switching transistor is coupled to the first output cascode transistor, and the gate of the first switching transistor receives the first control signal; and

the second switching transistor has a gate, a source and a drain, where the source of the second switching transistor is coupled to the second output mirror transistor, the drain of the second switching transistor is coupled to the second output cascode transistor, and the gate of the second switching transistor receives the second control signal.

10. (original) The charge pump as recited in claim 9 wherein:

the first output mirror, the first output cascode and the first switching transistors are n-channel MOS transistors; and

the second output mirror, the second output cascode, and the second switching transistors are p-channel MOS transistors.

11. (original) The charge pump as recited in claim 10 wherein:

the first output mirror transistor has a drain coupled to the source of the first switching transistor and a source coupled to a first voltage supply;

the first output cascode transistor has a source coupled to the drain of the first switching transistor and a drain coupled to the output node;

the second output mirror transistor has a drain coupled to the source of the second switching transistor and a source coupled to a second voltage supply; and

the second output cascode transistor has a source coupled to the drain of the second switching transistor and a drain coupled to the first output cascode transistor at the output node.

12. (currently amended) The charge pump as recited in claim 9 wherein the first and the second cascode current mirrors are a wide-swing cascode current ~~mirror~~ mirrors featuring high output impedance without greatly restricting signal swing.

13. (currently amended) The charge pump as recited in claim 12 wherein:
the first cascode current mirror further comprises:
a first input mirror transistor coupled ~~between~~ to the first output mirror transistor and a first voltage supply; and
a first input cascode transistor coupled ~~between~~ to the first output cascode transistor and the ~~first~~ reference current source; and
the second cascode current mirror further comprises:
a second input mirror transistor coupled ~~between~~ to the second output mirror transistor and a second voltage supply; and
a second input cascode transistor coupled ~~between~~ to the second output cascode transistor and the ~~second~~ reference current source.

14. (original) The charge pump as recited in claim 13 wherein:
the first input mirror and the first input cascode transistors are n-channel MOS transistors; and
the second input mirror and the second input cascode transistors are p-channel MOS transistors.

15. (currently amended) The charge pump as recited in claim 14 wherein:
the first input mirror transistor has a gate coupled to the first output mirror transistor and a source coupled to the first voltage supply;
the first input cascode transistor has a gate coupled to the first output cascode transistor and a drain coupled to the gate of the first input mirror transistor and the ~~first~~ reference current source;

the second input mirror transistor has a gate coupled to the second output mirror transistor and a source coupled to the second voltage supply; and
the second input cascode transistor has a gate coupled to the second output cascode transistor and a drain coupled to the gate of the second input mirror transistor and the ~~second~~ reference current source.

16 (original) A high-speed low-noise charge pump having an output node, comprising:

- a first cascode current mirror coupled to a reference current source, including a first output mirror transistor and a first output cascode transistor, for generating a first mirror current;
- a first switching transistor receiving a first control signal and interposed between the first output mirror and the first output cascode transistors, for causing the first mirror current to flow through the output node when the first control signal is asserted;
- a second cascode current mirror coupled to the first cascode current mirror at the output node, for generating a second mirror current; and
- a second switching transistor receiving a second control signal, for causing the second mirror current to flow through the output node when the second control signal is asserted.

17. (original) The charge pump as recited in claim 16 wherein the first switching transistor has a gate, a source and a drain, where the source of the first switching transistor is coupled to the first output mirror transistor, the drain of the first switching transistor is coupled to the first output cascode transistor, and the gate of the first switching transistor receives the first control signal.

18. (original) The charge pump as recited in claim 17 wherein:
- the first output mirror transistor has a drain coupled to the source of the first switching transistor and a source coupled to a voltage supply; and
 - the first output cascode transistor has a source coupled to the drain of the first switching transistor and a drain coupled to the output node.

19. (currently amended) The charge pump as recited in claim 16 wherein the first and the second cascode current mirrors are a wide-swing cascode current ~~mirror~~. mirrors featuring high output impedance without greatly restricting signal swing.

20. (original) The charge pump as recited in claim 19 wherein the first cascode current mirror further comprises:

a first input mirror transistor having a gate coupled to the first output mirror transistor and a source coupled to a voltage supply; and

a first input cascode transistor having a gate coupled to the first output cascode transistor and a drain coupled to the gate of the first input mirror transistor and the reference current source.